Continuation-based semantics for conventional implicatures and the Japanese benefactive

Yusuke Kubota
The Ohio State University
kubota@ling.ohio-state.edu

Wataru Uegaki
The University of Tokyo
w_uegaki@phiz.c.u-tokyo.ac.jp

SALT 19, OSU
April 4, 2009

1 Potts's (2005) theory of Conventional Implicatures (CIs)

1.1 What are CIs?

(1) John, **who is smart**, passed the exam.
at-issue: John passed the exam.
CI: John is smart.

Potts's (2005) definition of CIs:

(2) a. CIs are part of the **conventional** meanings of words.
b. CIs are commitments, and thus give rise to **entailments**.
c. CIs are **speaker oriented** (i.e., express commitments made by the speaker)
d. CIs are **independent** of at-issue contents.

Tests for CI-hood

Distinguishing CIs from at-issue contents

Unlike at-issue contents, CIs project through presupposition holes (e.g., negation, question, modals and antecedent of conditionals).

(3) a. #John didn't pass the exam, which was difficult. That is, the exam was very easy. (CI)
b. John didn't pass the exam, which was difficult. That is, he failed it. (at-issue)

(4) A: Did John, who is smart, pass the exam?
B: #No, he isn't smart although he passed the exam.

Distinguishing CIs from presuppositions

The truth value of the at-issue content can be determined even if the CI is false (whereas presupposition failure leads to uninterpretability modulo accommodation).[1,2]

(5) A: Did John, who is smart, pass the exam? (CI)
B: Yes, he did pass the exam. But just so you know, he isn't actually smart.

(6) A: Did John stop smoking? (presupposition)
B: #Yes. He doesn't smoke. But just so you know, he hasn't been a smoker to begin with.

[1]Examples like (i) might seem to constitute counterexamples to the generalization behind (5):

(i) A: Is the king of France bald?
B: No! France has no king!

However, the negative response by B here is arguably metalinguistic, since it does not make sense to deny the baldness of a nonexistent king. Thus, the very fact that examples like (i) can only be interpreted as metalinguistic negation supports the appropriateness of the characterization of presupposition as a definedness condition for the truth conditions of sentences.

[2]We do not include speaker-orientation as a test for CI-hood, since this criterion seems to be problematic. As Amaral et al. (2007) point out, there are clear cases where supplements, a typical case of CI triggers, generate CIs that are attributable to attitude-holders other than the speaker, such as the following:

(i) Joan believes that her chip, which she had installed last month, has a twelve year guarantee.
(ii) Sheila believes that Chuck, a sweetheart if she ever met one, is fit to watch the kids.
(Amaral et al. 2007:736,737)

1.2 Multidimensional logic for CIs: $\mathcal{L}_{\text{CI}}$

Types for $\mathcal{L}_{\text{CI}}$

Two kinds of types (both recursively defined):

- **at-issue type** (for modelling at-issue meanings):
  - basic types: e^a, t^a, s^a
  - complex types: $\langle \sigma^a, \tau^a \rangle$ (where σ^a and τ^a are at-issue types)
- **CI type** (for modelling CI meanings):
  - basic types: e^c, t^c, s^c
  - complex types: $\langle \sigma^a, \tau^c \rangle$ (where σ^a is an at-issue type and τ^c is a CI type)

Observations

The distinction between at-issue and CI meanings is explicitly encoded in the type system of the logic. This has several consequences.

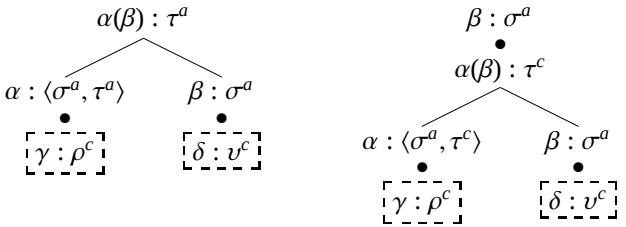
- The logic is **multidimensional** and CI meanings and at-issue meanings are formally treated as different **kinds** of entities.
- This neatly captures (2d), i.e., the **independence** of CI meanings from at-issue meanings. Since CI and at-issue meanings are different kinds of meanings (belonging to different types), they don't interact.
- For example, the scopelessness of CIs is captured in terms of the definition of well-formed types: a type of the form $\langle \sigma^c, \tau \rangle$ is explicitly excluded from the type definition. From this, it follows that no linguistic expression can take as its argument a CI type meaning.
- Another consequence that follows is the following:

  (7) No lexical item contributes both an at-issue and a CI meaning. (Potts 2005: 48)

  This is so, because every lexical item has to be well-typed, that is, it has to belong to either:
  - the at-issue type (in which case, it contributes an at-issue meaning only), or
  - the CI type (in which case, it contributes a CI meaning only, possibly by taking some expression as an argument).

Rules for semantic composition

(8) a. **at-issue application** b. **CI application**

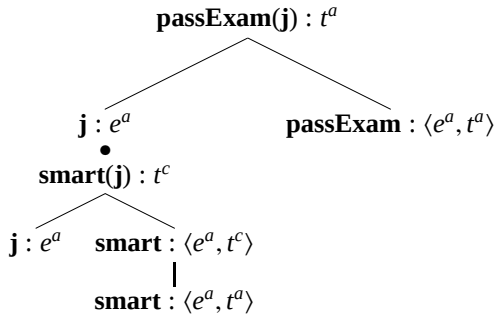


(• is a metalogical symbol for separating CI contents from at-issue contents)

- **At-issue application** is the ordinary function application rule for expressions having at-issue types.
- **CI application** is used when a functional expression of CI type applies to its argument. This rule does the following two things:
  - The at-issue content of the higher node is simply identified with the at-issue content of the argument.
  - The CI content of the higher node is obtained by applying the CI function to its argument.

Parsetree

The analysis for (1):



Parsetree interpretation

In $\mathcal{L}_{\text{CI}}$, to obtain the at-issue and CI meanings of a sentence, the whole parsetree is interpreted in the following manner:

(9) Let $\mathcal{T}$ be a semantic parsetree with the at-issue term $\alpha : \sigma^a$ on its root node, and distinct terms $\beta_1 : t^c$,..., $\beta_n : t^c$ on nodes in it. Then the interpretation of $\mathcal{T}$ is the tuple

$$\langle [\![\alpha : \sigma^a]\!], \{ [\![\beta_1 : t^c]\!], \ldots, [\![\beta_n : t^c]\!] \} \rangle$$

Note that this treatment of the semantic interpretation crucially makes use of a representational device, namely, a parsetree, in order to keep track of the CIs which arise during syntactic and semantics composition.

2 Japanese benefactives

The Japanese benefactive construction in (10) poses a problem for Potts's generalization in (7).

(10) Taroo-ga Hanako-ni piano-o hii-te **morat**-ta.
Taro-NOM Hanako-DAT piano-ACC play BENEF-PAST
at-issue: 'Taro made Hanako play the piano.'
CI: 'Taro's making Hanako play the piano was for the benefit of Taro himself.'

- The Japanese benefactive verb *morau* embeds another verb (*hii-te* "play" above) and identifies its own dative object (*Hanako* above) as the logical subject of the embedded verb.
- The sentence as a whole describes a causative event in which the matrix subject causes the embedded (logical) subject to do the action described by the embedded verb, which is a beneficial state of affair for the matrix subject.
- The causative meaning is an at-issue meaning, whereas the benefactive meaning is a CI.
- Thus, the lexical item *morau* is a counterexample to Potts's generalization (7), since it contributes both at-issue and CI meanings.
- There is no way in $\mathcal{L}_{\text{CI}}$ to account for sentences involving *morau*, since *morau* cannot be assigned an appropriate lexical entry in the first place.

Evidence for the CI-hood of the benefactive meaning

The benefactive meaning is not an at-issue content.

(11) **Projection out of the scope of negation**

#Taroo-wa Hanako-ni piano-o hii-te moraw-anakat-ta. Toiunomo,
Taro-TOP Hanako-DAT piano-ACC play BENEF-NEG-PAST for
[Taroo-ga Hanako-ni piano-o hik-ase-ta]-no-wa jibun-no
Taro-NOM Hanako-DAT piano-ACC play-CAUSE-PAST-COMP-TOP self-GEN
tame de-wa nakat-ta kara.
sake TOP NEG-PAST because

intended: 'Taro didn't have Hanako play the piano for him. For it was not for the benefit of himself that he made her play the piano.'

(12) **Projection out of the scope of question**

A: Taroo-wa Hanako-ni piano-o hii-te morat-ta-no?
Taro-TOP Hanako-DAT piano-ACC play BENEF-PAST-Q
'Did Taro make Hanako play the piano for him?'

B: #Iie. Datte, tasikani Taroo-wa Hanako-ni piano-o
no for certainly Taro-TOP Hanako-DAT piano-ACC
hik-ase-ta kedo, [Hanako-ga piano-o
play-CAUSE-PAST but, Hanako-NOM piano-ACC
hii-ta]-no-wa Taroo-no tame de-wa nai kara.
play-PAST-COMP-TOP Taro-GEN sake TOP NEG because
'No. For, Hanako's playing the piano was not for the benefit of Taro.'

The benefactive meaning is not a presupposition.

(13) **Independence of truth-conditions**

A: Taroo-wa Hanako-ni piano-o hii-te morat-ta-no?
Taro-TOP Hanako-DAT piano-ACC play BENEF-PAST-Q
'Did Taro make Hanako play the piano for him?'

B: Hai, tasikani Taroo-wa Hanako-ni piano-o hik-ase-ta-yo.
yes, certainly Taro-TOP Hanako-DAT piano-ACC play-cause-PAST-PRT
Demo, sore-wa Taroo jisin-no tame de-wa nai kedo.
but that-TOP Taro self-GEN sake TOP NEG though
'Yes, he did make her play the piano. But it wasn't for the benefit of himself that he did so.'

3 Continuation-based semantics for CIs

3.1 What are continuations?

- A technique originally developed in computer science for delaying the evaluation of an expression in a program to a later point in computation (cf. Barker 2002, 2004).
- Linguistic applications by Barker and Shan:
  - Quantifier scope (Barker 2002)
  - Donkey anaphora (Barker and Shan 2008)
  - WCO and superiority (Shan and Barker 2006)

3.2 Example: quantifier scope ambiguity (Barker and Shan 2008)

(14) Someone loves everyone.

a. $\exists x \forall y.\mathbf{love}(y)(x)$ (surface scope)

b. $\forall y \exists x.\mathbf{love}(y)(x)$ (inverse scope)

Lexicon:

(15) a. $\langle \textit{someone};\ \frac{S|S}{NP};\ \frac{\exists x.[]}{x} \rangle$

b. $\langle \textit{everyone};\ \frac{S|S}{NP};\ \frac{\forall x.[]}{x} \rangle$

Grammar rules:

(16) **Unary type-shifting rules**

a. $\langle \alpha;\ A;\ x \rangle \overset{\text{Lift}}{\Rightarrow} \langle \alpha;\ \frac{\boldsymbol{B}|\boldsymbol{B}}{A};\ \frac{[]}{x} \rangle$

b. $\langle \alpha;\ \frac{A|\boldsymbol{B}}{\boldsymbol{B}};\ \frac{f[]}{x} \rangle \overset{\text{Lower}}{\Rightarrow} \langle \alpha;\ A;\ f[x] \rangle$

(where B is either S or Assn)

(17) **Continuized application rules**

a. $\begin{pmatrix} \frac{C|\boldsymbol{D}}{A/\boldsymbol{B}} & \frac{\boldsymbol{D}|E}{\boldsymbol{B}} \\ \alpha & \beta \\ \frac{g[]}{f} & \frac{h[]}{x} \end{pmatrix} \overset{\mathbf{S}/}{\Rightarrow} \begin{matrix} \frac{C|E}{A} \\ \alpha\,\beta \\ \frac{g[h[]]}{f(x)} \end{matrix}$

b. $\begin{pmatrix} \frac{C|\boldsymbol{D}}{\boldsymbol{B}} & \frac{\boldsymbol{D}|E}{\boldsymbol{B}\backslash A} \\ \alpha & \beta \\ \frac{g[]}{x} & \frac{h[]}{f} \end{pmatrix} \overset{\mathbf{S}\backslash}{\Rightarrow} \begin{matrix} \frac{C|E}{A} \\ \alpha\,\beta \\ \frac{g[h[]]}{f(x)} \end{matrix}$

Derivations:

(18) a. (surface scope)

$$\begin{matrix} \frac{S|S}{NP} \\ \textit{someone} \\ \frac{\exists x.[]}{x} \end{matrix} \begin{pmatrix} \frac{S \mid S}{(NP\backslash S)/NP} & \frac{S|S}{NP} \\ \textit{loves} & \textit{everyone} \\ \frac{[]}{\mathbf{love}} & \frac{\forall y.[]}{y} \end{pmatrix}$$

$$= \begin{matrix} \frac{S|S}{S} \\ \textit{someone loves everyone} \\ \frac{\exists x.\forall y.[]}{\mathbf{love}(y)(x)} \end{matrix} \overset{\text{Lower}}{\Rightarrow} \begin{matrix} S \\ \textit{someone loves everyone} \\ \exists x \forall y.\mathbf{love}(y)(x) \end{matrix}$$

b. (inverse scope)

$$\left(\begin{array}{ccc} \frac{S|S}{S|S} & \frac{\frac{S}{S}\,|\,\frac{S}{S}}{(NP\backslash S)/NP} & \frac{S|S}{S|S} \\ NP & & NP \\ \textit{someone} & \textit{loves} & \textit{everyone} \\ \frac{[]}{\exists x.[]} & \frac{[]}{[]} & \frac{\forall y.[]}{[]} \\ x & \textbf{love} & y \end{array}\right) = \begin{array}{c} \frac{S|S}{S|S} \\ S \\ \textit{someone loves everyone} \\ \frac{\forall y.[]}{\exists x.[]} \\ \textbf{love}(y)(x) \end{array}$$

Lower (twice) ⇒

$$\begin{array}{c} S \\ \textit{someone loves everyone} \\ \forall y \exists x.\textbf{love}(y)(x) \end{array}$$

3.3 Continuation-based semantics for CIs

3.3.1 Guiding intuitions

- CIs are chunks of meaning that are **independent** of the at-issue meanings.
- CIs **project**:
  - Typically, they are speaker-oriented.
  - They don't interact with at-issue meanings.
- This can be thought of as a case of **delayed evaluation**.
  - CI triggers make meaning contributions that are not evaluated in the immediate local contexts.
  - Instead, we wait until a larger context is found that licenses the evaluation of these meaning contributions (which is typically the matrix level assertion).
- So, we can treat CIs via the technique of continuations.
  - We introduce a distinct continuation level for keeping track of CI meanings in linguistic composition (shown above the line in the 'tower' notation).
  - This continuation level is kept separate from the at-issue meaning by 'locking' it into a special syntactic category Assn.

  - Syntax ensures that continuized CIs can be unlocked and integrated with the at-issue meaning only when an appropriate environment is found (typically, the matrix level assertion).

3.3.2 Illustration: Nonrestrictive relative clauses

(19) John, who is smart, passed the exam.

(20) $\langle \textit{who};\ \left(NP\backslash\frac{Assn|Assn}{NP}\right)/(NP\backslash S);\ \lambda P\lambda x.\frac{P(x)\wedge[]}{x}\rangle$

(21) **'Assertion' rule**

$\langle \alpha;\ S;\ x\rangle \overset{\mathbf{A}}{\Rightarrow} \langle \alpha;\ Assn;\ x\rangle$

(22) a.

$$\left(\begin{array}{cc} \left(NP\backslash\frac{Assn|Assn}{NP}\right)/(NP\backslash S) & NP\backslash S \\ \textit{who} & \textit{is smart} \\ \lambda P\lambda x.\frac{P(x)\wedge[]}{x} & \textbf{smart} \end{array}\right) = \begin{array}{c} NP\backslash\frac{Assn|Assn}{NP} \\ \textit{who is smart} \\ \lambda x.\frac{\textbf{smart}(x)\wedge[]}{x} \end{array}$$

b.

$$\left(\begin{array}{cc} NP & NP\backslash\frac{Assn|Assn}{NP} \\ \textit{John} & \textit{who is smart} \\ \textbf{j} & \lambda x.\frac{\textbf{smart}(x)\wedge[]}{x} \end{array}\right) = \begin{array}{c} \frac{Assn|Assn}{NP} \\ \textit{John, who is smart} \\ \frac{\textbf{smart}(\textbf{j})\wedge[]}{\textbf{j}} \end{array}$$

- At the at-issue level, the relative clause is an identity function (22a).
- But it applies to the NP it modifies to generate a CI that is stored at the CI level (22b).

c.

$$\left(\begin{array}{cc} \frac{Assn|Assn}{NP} & \frac{Assn|Assn}{NP\backslash S} \\ \textit{John, who is smart} & \textit{passed the exam} \\ \frac{\textbf{smart}(\textbf{j})\wedge[]}{\textbf{j}} & \frac{[]}{\lambda x.\textbf{passExam}(x)} \end{array}\right) = \begin{array}{c} \frac{Assn|Assn}{S} \\ \textit{John, who is smart,} \\ \textit{passed the exam} \\ \frac{\textbf{smart}(\textbf{j})\wedge[]}{\textbf{passExam}(\textbf{j})} \end{array}$$

- The VP *passed the exam* undergoes Lift (step omitted in the derivation) so that it can combine with the subject that has a continuation level.
- By combining the subject and the VP with continuized function application (17b), the CI is projected to the whole sentence.

d.

$$\text{(22c)}\quad \begin{array}{c} \dfrac{\text{Assn}\,|\,\mathbf{Assn}}{\mathbf{Assn}} \\ \mathbf{A} \\ \Rightarrow \end{array} \begin{array}{c} \textit{John, who is smart,} \\ \textit{passed the exam} \\ \mathbf{smart(j)} \wedge [\,] \\ \hline \mathbf{passExam(j)} \end{array} \quad \text{Lower} \Rightarrow \quad \begin{array}{c} \text{Assn} \\ \textit{John, who is smart,} \\ \textit{passed the exam} \\ \mathbf{smart(j)} \wedge \mathbf{passExam(j)} \end{array}$$

- Once the sentence is built up, the 'Assertion' rule (21) applies to change the local syntactic category to Assn.
- Once the local syntactic category is Assn, Lower can apply to integrate the CI with the at-issue meaning.

Remarks

- The independence of the CI is guaranteed by assigning a distinct syntactic category Assn for the continuation level.
  - The CI is stored in this continuation level and it can be lowered only when the local syntactic category is Assn.
  - We assume that Assn is not embeddable (except possibly by propositional attitude predicates, which seem to be able to embed at least certain kinds of CIs; cf. Amaral et al. (2007)).
  - So, the projection behavior is straightforwardly captured.
- All of the syntactic/semantic composition is done in terms of the fully general mechanism for handling continuations. Thus, unlike Potts's $\mathcal{L}_{\text{CI}}$:
  - No type distinction is needed for at-issue and CI meanings.
  - No special rule is needed for calculating CIs.
  - No representational device is needed for retrieving the CIs after the meaning of the sentence is calculated.

3.3.3 Japanese benefactive

Unlike Potts's $\mathcal{L}_{\text{CI}}$, our continuation-based system does not entail (7). Thus, an analysis of the Japanese benefactive is straightforward.

$$\text{(23)}\quad \langle \textit{morau};\ (\text{NP}_n\backslash\text{S})\backslash\text{NP}_d\backslash\text{NP}_n\backslash\frac{\text{Assn}\,|\,\text{Assn}}{\text{S}};\ \lambda f\lambda x\lambda y.\frac{\mathbf{benef}(y, f(x)) \wedge [\,]}{\mathbf{cause}(y, f(x))}\rangle$$

(24)

$$\left(\begin{array}{c}\text{NP}_n\\ \textit{Taroo-ga}\\ \mathbf{t}\end{array}\ \left(\begin{array}{c}\text{NP}_d\\ \textit{Hanako-ni}\\ \mathbf{h}\end{array}\ \left(\begin{array}{cc}\text{NP}_n\backslash\text{S} & (\text{NP}_n\backslash\text{S})\backslash\text{NP}_d\backslash\text{NP}_n\backslash\frac{\text{Assn}\,|\,\text{Assn}}{\text{S}}\\ \textit{piano-o hii-te} & \textit{morat-ta}\\ \mathbf{playPiano} & \lambda f\lambda x\lambda y.\frac{\mathbf{benef}(y, f(x)) \wedge [\,]}{\mathbf{cause}(y, f(x))}\end{array}\right)\right)\right)$$

$$= \begin{array}{c} \dfrac{\text{Assn}\,|\,\text{Assn}}{\text{S}} \\ \textit{Taroo-ga Hanak-ni} \\ \textit{piano-o hii-te morat-ta} \\ \dfrac{\mathbf{benef}(\mathbf{t}, \mathbf{playPiano}(\mathbf{h})) \wedge [\,]}{\mathbf{cause}(\mathbf{t}, \mathbf{playPiano}(\mathbf{h}))} \end{array} \quad \begin{array}{c} \mathbf{A} \\ \Rightarrow \end{array} \quad \begin{array}{c} \dfrac{\text{Assn}\,|\,\text{Assn}}{\text{Assn}} \\ \textit{Taroo-ga Hanak-ni} \\ \textit{piano-o hii-te morat-ta} \\ \dfrac{\mathbf{benef}(\mathbf{t}, \mathbf{playPiano}(\mathbf{h})) \wedge [\,]}{\mathbf{cause}(\mathbf{t}, \mathbf{playPiano}(\mathbf{h}))} \end{array}$$

$$\text{Lower} \Rightarrow \quad \begin{array}{c} \text{Assn} \\ \textit{Taroo-ga Hanak-ni piano-o hii-te morat-ta} \\ \mathbf{benef}(\mathbf{t}, \mathbf{playPiano}(\mathbf{h})) \wedge \mathbf{cause}(\mathbf{t}, \mathbf{playPiano}(\mathbf{h})) \end{array}$$

- *Morau* contributes both an at-issue meaning (shown below the line) and a CI meaning (shown above the line). (Unlike the nonrestrictive relative clause, the at-issue meaning is not an identity function.)
- Again, no special mechanism is needed; everything is done with the already available mechanism for computing continuations.

4 Discussion

4.1 Other empirical phenomena that cannot be handled in $\mathcal{L}_{\text{CI}}$

Along with the Japanese benefactive verb *morau* that we have analyzed above, there are several phenomena that seem not to be analyzable in $\mathcal{L}_{\text{CI}}$. These phenomena include those that challenge Potts's generalization (7), as well as cases

where a CI trigger removes altogether the at-issue content of the expression that it attaches to.

Other benefactive verbs

In addition to *morau* analyzed above, Japanese has other 'auxiliary' verbs that express benefactive meanings, which differ in the orientations of the benefactive meanings involved.

(25)

	benefactor	beneficiary	logical subject of the embedded verb
morau	dative object	subject	dative object
ageru, *yaru*	subject	dative object†	subject
kureru	subject	dative object‡	subject

†: restricted to non-first person

‡: restricted to speaker or speaker's in-crowd

(26) Hanako-ga Taroo-ni piano-o hii-te **age**-ta.
Hanako-NOM Taro-DAT piano-ACC play BENEF-PAST
at-issue: 'Hanako played the piano.'
CI: 'Hanako's playing the piano was for the benefit of Taro.'

These benefactive verbs all involve an augmentation/alternation of the argument structure of the verb at the at-issue level and an addition of some benefactive meaning at the CI level, and, hence, are problematic for Potts's $\mathcal{L}_{\text{CI}}$.

Indirect passive

Japanese has the so-called 'indirect passive' construction, expressed by attaching the passive morpheme *-(r)are* to the verb root.

(27) Hanako-ga Taroo-ni nak-**are**-ta.
Hanako-NOM Taro-DAT cry-PASS-PAST
at-issue: 'Taro cried.'
CI: 'Taro's crying annoyed Hanako.'

The indirect passive is like the benefactive verb *morau* in that it changes the argument structure of the verb it attaches to. Specifically:

- It 'demotes' the logical subject (*Taroo-ni* in (27)) of the embedded verb to a dative argument.
- It adds a new subject (*Hanako-ga* in (27)) to the sentence.

In addition to this effect on the at-issue content, the passive morpheme *-(r)are* (in its indirect passive use) contributes the CI meaning that (the referent of) the surface subject is adversely affected by the event described by the embedded verb.

Suppletive honorific forms

In addition to the regular honorific form *o-V-ni naru* (cf. Potts and Kawahara (2004) for a treatment of Japanese honorifics in a multidimensional CI logic), Japanese has irregular suppletive honorific forms in which the lexical verb and the honorific morpheme can't be separated morphologically (cf., e.g., Harada 1976). E.g.:

(28) *mesiagaru* "eat.HON"
irassyaru "go/come/be.HON"
ossyaru "say.HON"

(29) Sensei-ga o-susi-o **mesiagat**-ta.
Teacher-NOM POL-sushi-ACC eat.HON-PAST
at-issue: 'The teacher ate sushi.'
CI: 'The speaker respects the teacher.'

If honorifics (which are a kind of expressives) are to be analyzed in terms of a multidimensional theory of CIs of the kind developed by Potts (2005) and further elaborated in this paper, these suppletive honorific forms in Japanese present problems for Potts's original CI logic since they contribute to the at-issue and CI dimensions at the same time.

***Yokumo* and *sekkaku* (McCready 2009)**

McCready (2009) argues that two adverbials expressions in Japanese, *yokumo* and *sekkaku*, have meanings that cannot be treated in Potts's original $\mathcal{L}_{\text{CI}}$.

(30) Yokumo ki-ta na!
YOKUMO come-PAST PRT
'You have a lot of guts to come here!'

In McCready's (2009) analysis, '*yokumo* ϕ' means (roughly):

- **CI:** The speaker is surprised that ϕ and (s)he has a certain (typically negative) attitude toward ϕ.
- **presupposition:** ϕ

That is, *yokumo* deprives the proposition it modifies of its at-issue contribution so that '*yokumo* ϕ' doesn't assert anything at all. This can't be modelled in Potts's $\mathcal{L}_{\mathrm{CI}}$ and McCready proposes an augmentation of $\mathcal{L}_{\mathrm{CI}}$ by adding a new type (called 'shunting type') and new rule schemas.

Another case discussed by McCready is similar to the benefactive *morau* in that it contributes both at-issue and CI contents at the same time.

(31) Sekkaku ki-ta noni, Taroo-wa i-nakat-ta.
SEKKAKU come-PAST though Taro-TOP be-NEG-PAST
'Even though I took the trouble to come, Taro wasn't there.'

According to McCready's (2009), '*sekkaku* ϕ' means (roughly):

- **at-issue:** ϕ is true and ϕ is intentional.
- **CI:** ϕ normally has some positive consequence.

Again, McCready proposes an augmentation of Potts's $\mathcal{L}_{\mathrm{CI}}$ by adding a product type (and a new set of rules) to deal with cases like this.

We think that our continuation-based system can handle these cases by just assigning appropriate lexical entries for the adverbials. But the meanings of these adverbials are rather complex and we leave a detailed investigation for future work.

4.2 Some technical issues

4.2.1 Binding 'problem'

There are apparent cases involving the Japanese benefactive construction that seem to show that a quantifier at the at-issue dimension can bind into a CI content:

(32) Taroo-wa **dono gakusei-ni-mo** syoko-no seiri-o tetudat-te
Taro-TOP every student-DAT archive-GEN rearrangement-ACC help
morat-ta.
BENEF-PAST
'Taro had every student help with the rearrangement of the archive for him.'

If this is really a case of binding across dimensions, it would be problematic for our analysis, since quantifiers shouldn't be able to scope over Assn.

However, there is evidence that (32) doesn't constitute a true case of binding across dimensions. That is, Potts's generalization that quantifiers can't bind across dimensions seems correct.[3] Consider the following:[4]

(33) Dono gakusei-mo peepaa-o dasi-te kure-reba, kimatu.siken-o
every student paper-ACC submit BENEF-COND final.exam-ACC
okonaw-anai.
do-NEG
'If every student submits a paper, I'll not give a final exam.'

Two possibilities for analyzing (33) as a case of binding into the CI:

- Let the quantifier scope out of the conditional and bind the CI that projects up to the top sentence level.
- Let the quantifier bind the CI inside the conditional.

Both of these possibilities lead to incorrect results.

The first possibility gets the scope of the quantifier wrong, since, intuitively, the sentence is asserting that the condition for no exam is for **all** of the students to submit papers. (That is, the quantifier needs to scope inside the conditional in order to get the at-issue assertion right.)

The second possibility leads to the following incorrect prediction. Suppose a situation in which the following hold:

(i) All of the students actually submit their papers.

(ii) All of the students submitting their papers is not a beneficial state of affairs for the speaker (e.g., since grading papers involves a lot of work).

(iii) There will be a final exam.

In this situation, the sentence is intuitively false, since, even though the antecedent of the conditional is true (i), the consequent doesn't hold (iii). However, if the quantifier were to scope inside the antecedent of the conditional and bind the CI

[3] See also Amaral et al. (2007). Although Amaral et al. (2007) argue that Potts's treatment in which CIs are completely kept separate from at-issue contents seems to be too simplistic given the interactions between presuppositions triggered by at-issue contents and CIs (cf. below), they admit that the impossibility of binding across dimensions seems to be a true generalization.

[4] Here, we have used the *kureru* benefactive instead of *morau* for the sake of exposition.

content, then (33) would be predicted to be true in this situation, since the antecedent would be false given (ii).

What seems to be happening in (32) (and (33)) instead is that the CI is really predicated of a set of individuals that are contextually salient. In other words, this is a case that parallels discourse anaphora rather than true quantificational binding. (For a similar idea for apparent cases of binding across dimensions with supplements, see Potts (2005).) The analysis of benefactives formulated above is actually too simplistic in this respect since it yields the relevant CI by binding (i.e. identifying the relevant variables) across dimensions. This means that we need to slightly modify the lexical entry for *morau* along the following lines:

(34) $\langle morau; (\mathrm{NP}_n\backslash\mathrm{S})\backslash\mathrm{NP}_d\backslash\mathrm{NP}_n\backslash\frac{\mathrm{Assn}|\mathrm{Assn}}{\mathrm{S}};$
$\lambda f\lambda x\lambda y.\frac{\forall z[[\mathbf{C}(z)\wedge f(z)]\rightarrow \mathbf{benef}(y,f(z))]\wedge[\ ]}{\mathbf{cause}(y,f(x))}\rangle$

The point here is that the variable x now doesn't appear in the CI dimension. Instead, the CI says that, for all of the individuals that are contextually salient (i.e. $\mathbf{C}(z)$) and for which $f(z)$ is true, $f(z)$ is a beneficial state of affairs for the subject.

With this entry, (32) ends up conventionally implicating that, whoever happened to help rearranging the archive, that person's doing so was beneficial to Taro. Combined with the at-issue assertion that every student helped rearrange the archive, the sentence **effectively** ends up implicating that every student's helping rearranging the archive was beneficial to Taro. Note also that this yields the right meaning for the conditional example (33), too. The quantifier scopes inside the antecedent of the conditional at the at-issue level but the CI projects to the matrix sentence level. And this CI arising from the benefactive says that, whoever submits a paper, that person's doing so is a beneficial state of affairs to the speaker. This seems to accurately represent the meaning of the sentence.

The lexical entry for *morau* above should be further revised since there are cases where the subject is a quantifier:

(35) **Dono kyoozyu-mo** Hanako-ni ofisu-no seiri-o tetudat-te
every professor Hanako-DAT office-GEN rearrangement-ACC help
morat-ta.
BENEF-PAST
'Every professor had Hanako help him/her rearrange the office.'

That is, the subject slot shouldn't bind into the CI directly either. So, the entry for *morau* is now:

(36) $\langle morau; (\mathrm{NP}_n\backslash\mathrm{S})\backslash\mathrm{NP}_d\backslash\mathrm{NP}_n\backslash\frac{\mathrm{Assn}|\mathrm{Assn}}{\mathrm{S}};$
$\lambda f\lambda x\lambda y.\frac{\forall z,w[[\mathbf{C}(z)\wedge\mathbf{C}(w)\wedge\mathbf{cause}(w,f(z))]\rightarrow\mathbf{benef}(w,f(z))]\wedge[\ ]}{\mathbf{cause}(y,f(x))}\rangle$

4.2.2 Recursive embedding of benefactive predicates

Notice that, in the final entry for *morau* in (36) in the previous section, it is not necessary to make the subject and dative object be potentially able to bind into the CI content. So, we can further revise the lexical entry for *morau* as follows:

(37) $\langle morau; (\mathrm{NP}_n\backslash\mathrm{S})\backslash\frac{\mathrm{Assn}|\mathrm{Assn}}{\mathrm{NP}_d\backslash\mathrm{NP}_n\backslash\mathrm{S}};$
$\lambda f.\frac{\forall z,w[[\mathbf{C}(z)\wedge\mathbf{C}(w)\wedge\mathbf{cause}(w,f(z)]\rightarrow\mathbf{benef}(w,f(z))]\wedge[\ ]}{\lambda x\lambda y.\mathbf{cause}(y,f(x))}\rangle$

This revision enables a straightforward treatment of cases in which one benefactive predicate is embedded inside another. Our continuation-based grammar automatically takes care of such cases without any additional mechanism. Consider the following:

(38) Taroo-wa Hanako-ni Jiroo-ni hon-o yon-de **age-te morat-ta**.
Taro-TOP Hanako-DAT Jiro-DAT book-ACC read BENEF BENEF-PAST
'Taro had Hanako read a book for Jiro.'

Here, the object-oriented benefactive *ageru* is embedded inside the subject-oriented benefactive *morau*. The sentence expresses the proposition given in the above translation and additionally has the CIs that Hanako's reading the book for Jiro was beneficial to Jiro (*ageru*) and that it was beneficial to Taro (*morau*).

We assume the following lexical entry for *ageru*:

(39) $\langle ageru; (\mathrm{NP}_n\backslash\mathrm{S})\backslash\frac{\mathrm{Assn}|\mathrm{Assn}}{\mathrm{NP}_d\backslash\mathrm{NP}_n\backslash\mathrm{S}};$
$\lambda f.\frac{\forall z,w[[\mathbf{C}(z)\wedge\mathbf{C}(w)\wedge f(z)\wedge\mathbf{involved}(w,f(z))]\rightarrow\mathbf{benef}(w,f(z))]\wedge[\ ]}{\lambda x\lambda y.f(y)\wedge\mathbf{involved}(x,f(y))}\rangle$

involved is a relation that holds of an individual x and a proposition P such that **involved**(x, P) is true if and only if x is involved in the event described by P. The intuition behind this is that the dative argument of *ageru* has to be such that, even though it is not an obligatory argument of the embedded verb, it is involved in and is thus a participant of the event described by the whole benefactive sentence.

With the lexical entries for *morau* and *ageru* in (36) and (39), the analysis for (38) is straightforward.

The most deeply embedded VP *Jiroo-ni hon-o yon-de age-te* itself has a continuation layer and is of syntactic category $\frac{\text{Assn}|\text{Assn}}{\text{NP}_n\backslash\text{S}}$ and has the semantics:

(40) $$\frac{\forall z, w[[\mathbf{C}(z) \wedge \mathbf{C}(w) \wedge \textbf{r-b}(z) \wedge \textbf{involved}(w, \textbf{r-b}(z))] \rightarrow \textbf{benef}(w, \textbf{r-b}(z))] \wedge [\,]}{\lambda y.\textbf{r-b}(y) \wedge \textbf{involved}(\mathbf{j}, \textbf{r-b}(y))}$$

In order to combine this embedded VP, *morat-ta* undergoes Lift, resulting in syntactic category $\frac{\text{Assn}\ |\ \text{Assn}}{(\text{NP}_n\backslash\text{S})\backslash\frac{\text{Assn}|\text{Assn}}{\text{NP}_d\backslash\text{NP}_n\backslash\text{S}}}$ and semantics:

(41) $$\frac{[\,]}{\lambda f.\frac{\forall z, w[[\mathbf{C}(z) \wedge \mathbf{C}(w) \wedge \textbf{cause}(w, f(z))] \rightarrow \textbf{benef}(w, f(z))] \wedge [\,]}{\lambda x\lambda y.\textbf{cause}(y, f(x))}}$$

Combining (40) and (41) yields:

(42) $$\frac{\begin{array}{c}\forall z, w[[\mathbf{C}(z) \wedge \mathbf{C}(w) \wedge \textbf{r-b}(z) \wedge \textbf{inv}(w, \textbf{r-b}(z))] \\ \rightarrow \textbf{benef}(w, \textbf{r-b}(z))] \wedge [\,]\end{array}}{\begin{array}{c}\forall z, w[[\mathbf{C}(z) \wedge \mathbf{C}(w) \wedge \textbf{cause}(z, \textbf{r-b}(w) \wedge \textbf{inv}(\mathbf{j}, \textbf{r-b}(w)))] \\ \rightarrow \textbf{benef}(z, \textbf{r-b}(w) \wedge \textbf{inv}(\mathbf{j}, \textbf{r-b}(w)))] \wedge [\,]\end{array}}{\lambda x\lambda y.\textbf{cause}(y, \textbf{r-b}(x) \wedge \textbf{inv}(\mathbf{j}, \textbf{r-b}(x)))}$$

This then combines with doubly Lifted dative and nominative NPs to yield:

(43) $$\frac{\begin{array}{c}\forall z, w[[\mathbf{C}(z) \wedge \mathbf{C}(w) \wedge \textbf{r-b}(z) \wedge \textbf{inv}(w, \textbf{r-b}(z))] \\ \rightarrow \textbf{benef}(w, \textbf{r-b}(z))] \wedge [\,]\end{array}}{\begin{array}{c}\forall z, w[[\mathbf{C}(z) \wedge \mathbf{C}(w) \wedge \textbf{cause}(z, \textbf{r-b}(w) \wedge \textbf{inv}(\mathbf{j}, \textbf{r-b}(w)))] \\ \rightarrow \textbf{benef}(z, \textbf{r-b}(w) \wedge \textbf{inv}(\mathbf{j}, \textbf{r-b}(w)))] \wedge [\,]\end{array}}{\textbf{cause}(\mathbf{t}, \textbf{r-b}(\mathbf{h}) \wedge \textbf{inv}(\mathbf{j}, \textbf{r-b}(x)))}$$

as the meaning for the whole sentence. Then, by applying Lower twice, we get the final translation for the sentence:

(44) $\forall z, w[[\mathbf{C}(z) \wedge \mathbf{C}(w) \wedge \textbf{r-b}(z) \wedge \textbf{inv}(w, \textbf{r-b}(z))] \rightarrow \textbf{benef}(w, \textbf{r-b}(z))] \wedge \forall z, w[[\mathbf{C}(z) \wedge \mathbf{C}(w) \wedge \textbf{cause}(z, \textbf{r-b}(w) \wedge \textbf{inv}(\mathbf{j}, \textbf{r-b}(w)))] \rightarrow \textbf{benef}(z, \textbf{r-b}(w) \wedge \textbf{inv}(\mathbf{j}, \textbf{r-b}(w)))] \wedge \textbf{cause}(\mathbf{t}, \textbf{r-b}(\mathbf{h}) \wedge \textbf{inv}(\mathbf{j}, \textbf{r-b}(\mathbf{h})))$

4.2.3 The device for separating at-issue and CI dimensions

Above, we have simply conjoined at-issue and CI contents with the boolean conjunction $\wedge$. However, this seems to be a bit too simplistic, since, in this formulation, the at-issue and CI contents will no longer be distinguishable from one another once Lower applies to yield the final translation for the sentence.

We speculate that a formally more adequate treatment should treat the meanings of sentences in terms of ordered pairs, the first element of which is the CI and the second element of which is the at-issue content. That is, the above lexical entry for *morau* should be further revised along the following lines:

(45) $$\begin{array}{l}\langle \textit{morau}; (\text{NP}_n\backslash\text{S})\backslash\frac{\text{Assn}|\text{Assn}}{\text{NP}_d\backslash\text{NP}_n\backslash\text{S}}; \\ \lambda f.\frac{\langle \forall z, w[[\mathbf{C}(z) \wedge \mathbf{C}(w) \wedge \textbf{cause}(w, f(z))] \rightarrow \textbf{benef}(w, f(z))], [\,]\rangle}{\lambda x\lambda y.\textbf{cause}(y, f(x))}\rangle\end{array}$$

(45) works appropriately at least for cases in which *morau* is the only CI-trigger in the sentence, but this entry should be revised further to treat cases involving multiple CI triggers, that is, cases discussed in the previous subsection. We leave investigations into this for future work.

4.3 Other issues

We do not attempt in this paper to address all of the issues concerning CIs (some of which have received attention in the recent literature partly in response to Potts's treatment of CIs in his $\mathcal{L}_{\text{CI}}$). We list here some of these unresolved issues.

4.3.1 Presuppositional interaction between CIs and at-issue contents

There are cases where a presupposition triggered in an at-issue content is satisfied by information in a CI content (46a), and vice versa (46b) (Amaral et al. 2007).

(46) a. John, who has two motorcycles, wants his wife to get one **too**.
b. It seems like every time I turn around, my neighbor with a motorcycle is dating a different woman, who always has one **too**.
(Amaral et al. 2007:741)

As in Potts's $\mathcal{L}_{\text{CI}}$, this kind of interaction between at-issue and CI contents is unexpected in the current proposal. This is so, because, as it currently stands, our system (like Potts's $\mathcal{L}_{\text{CI}}$) keeps information in the two dimensions strictly apart.

BUT: Our approach provides at least a starting point for a solution to this problem.

- In our approach (unlike in Potts's $\mathcal{L}_{\text{CI}}$), all CI contents are passed up at each step of meaning composition to the larger linguistic expression (and ultimately to the whole sentence).
- This leaves open a possibility in which at-issue and CI contents interact at each of the compositional steps.

(NOTE: By contrast, it is very difficult to imagine a treatment along these lines in Potts's $\mathcal{L}_{\text{CI}}$, where CI contents are distributed at local positions within the entire parsetree of the sentence and can only be retrieved after the computation of the whole sentence is completed.)

Of course, it is nontrivial to work out such a treatment and we leave this topic for future research.

4.3.2 The performative nature of expressives

Expressives have performative nature which supplements do not have (Kaplan 1999; Bach 2006).

- Expressive contents cannot be challenged or disagreed by an interlocutor.

(47) A: I met **damn** John at the library.
B: #(Sure, he's always at the library, but) that's wrong!
intended: #Your expressing your negative attitude toward John is wrong, since, in fact, you don't have a negative attitude toward him.

- Expressives are not propositional. When a speaker uses an expressive such as *damn*, (s)he is not asserting the proposition that "I have this negative feeling", but rather **expressing** the negative feeling itself.

If expressives are performative and **non-propositional** in nature, Potts's (2005) treatment of expressives as CIs seems problematic. Potts treats all CIs—whether they are supplements or expressives—uniformly as being of type t^c. This has the consequence that they are treated as meanings that are **asserted** by the speaker and can thus potentially be disagreed or challenged by an interlocutor. While this treatment is appropriate for certain kinds of CIs including supplements, it doesn't seem to be appropriate for expressives for the reason given above. (Actually, Potts (2007) recognizes that expressives convey radically different kinds of meanings both from CIs triggered by supplements and from at-issue contents, and develops a new semantics for expressives that employs a type system which is different from what is originally proposed in Potts (2005).)

Our continuation-based formulation does not differ from Potts's theory in treating CIs as being inherently propositional. At the moment, we do not have anything to say about how expressive meanings should be formally analyzed.

5 Conclusion

(48) [T]he theory of CIs fits well into this overall research program [i.e. direct compositionality *a la* Jacobson (1999)], with a slight caveat: to fully comply with Jacobson's tenets, we move the meaning language distinctions into the (categorial) syntax, as semantically informed syntactic categories. (Potts 2005: 73)

Our continuation-based reformulation of Potts's CI logic can be thought of as making good on his promissory remark in (48).

- Our grammar fully complies with **direct compositionality**.
  - Continuized meanings can be written as ordinary lambda terms. So, each linguistic expression has a well-defined meaning.
  - At each step of derivation, the meaning of the larger expression is calculated strictly based on the meanings of its components.
  - With appropriate lexical specifications for CI triggers, and with successive applications of local meaning composition, the right CI and at-issue meanings are assigned to the whole sentence. No representational device is needed for keeping track of CIs.
- It is the **'semantically informed' syntactic categories** that ensure that CI meanings are computed separately from at-issue meanings.

  - The meaning language distinction is eliminated (since we don't have a meaning language to begin with).

But:

  - Syntax ensures that the continuation tower can be collapsed only when the local syntactic category matches the continuized category Assn.

We have argued that our continuation-based reformulation is both conceptually and empirically more adequate than Potts's original CI logic.

- CIs are just a special case of **delayed evaluation**, which is found in other linguistic phenomena (such as quantifier scope).
  - Thus, they can be handled by a general mechanism for handling delayed evaluation, namely, continuations.
  - We don't need to redesign the architecture of grammar and treat CIs in terms of a dedicated logical language.
- The analysis in terms of continuations handles straightforwardly cases that pose problems for Potts's $\mathcal{L}_{\text{CI}}$.
  - Potts's $\mathcal{L}_{\text{CI}}$ is designed to predict that a lexical item cannot contribute both an at-issue meaning and a CI meaning.
  - But empirically, this predication is too strong. There are cases like the Japanese benefactive (and other phenomena discussed in section 4) that counterexemplify this prediction.
  - Given that the distinction between at-issue and CI meanings is encoded directly in the type system, modifying Potts's $\mathcal{L}_{\text{CI}}$ to accommodate such cases seems to complicate the overall system in a nontrivial way (cf. McCready (2009) for a concrete proposal along these lines, which increases the number of types and rule schemas).
  - By contrast, our system doesn't posit a type distinction between at-issue and CI meanings. The multidimensionality is instead captured by the continuation level together with the 'semantically informed' syntactic category Assn. So, cases like the Japanese benefactive aren't problematic.

References

Amaral, Patricia, Craige Roberts, and E. Allyn Smith. 2007. Review of *The Logic of Conventional Implicatures* by Chris Potts. *Linguistics and Philosophy* 30:707–749.

Bach, Kent. 2006. Review of Christopher Potts, *The Logic of Conventional Implicatures*. *Journal of Linguistics* 42(2):490–495.

Barker, Chris. 2002. Continuations and the nature of quantification. *Natural Language Semantics* 10(3):211–242.

Barker, Chris. 2004. Continuations in natural language. In H. Thielecke, ed., *Proceedings of the Fourth ACM SIGPLAN Continuations Workshop (CW'04)*, 1–11.

Barker, Chris and Chung-chieh Shan. 2008. Donkey anaphora is in-scope binding. *Semantics and Pragmatics* 1:1–42.

Harada, S. I. 1976. Honorifics. In M. Shibatani, ed., *Syntax and Semantics*, vol. 5: Japanese Generative Grammar, 499–561. New York: Academic Press.

Jacobson, Pauline. 1999. Towards a variable-free semantics. *Linguistics and Philosophy* 22(2):117–184.

Kaplan, David. 1999. What is meaning? Explorations in the theory of *meaning as use*. brief version — draft 1. Ms., UCLA.

McCready, Eric. 2009. Varieties of conventional implicature: Evidence from Japanese. Ms., Aoyama Gakuin University.

Potts, Christopher. 2005. *The Logic of Conventional Implicatures*. Oxford: Oxford University Press.

Potts, Christopher. 2007. The expressive dimension. *Theoretical Linguistics* 33(2):165–197.

Potts, Christopher and Shigeto Kawahara. 2004. Japanese honorifics as emotive definite descriptions. In K. Watanabe and R. B. Young, eds., *Proceedings of the 14th Conference on Semantics and Linguistic Theory*, 235–254. Ithaca, NY: CLC Publications.

Shan, Chung-chieh and Chris Barker. 2006. Explaining crossover and superiority as left-to-right evaluation. *Linguistics and Philosophy* 29(1):91–134.